RE SOURCES

Stormwater Outfall Monitoring Program

1 year summary | March 2022

Summary

RE Sources began monitoring 6 stormwater outfalls and 2 urban creek outlets flowing into Bellingham Bay on a monthly basis starting in Feb 2021. Basic water quality parameters were measured including dissolved oxygen, water temperature, conductivity, pH, ammonia, turbidity, and Escherichia coli (*E. coli*). The water was also monitored for visuals (sheens, bubbles…), odor, color, and flow. All of the outfalls and creeks failed to meet water quality standards at least once during the sampling period but there was great variability between the monitoring sites. One outfall was rated as "Good" because it only had a few exceedances. Two outfalls were rated as "Watch" because they had a moderate amount of exceedances and some that could have been due to natural causes. Three of the outfalls were rated as "Threat" because they frequently violated water quality standards mainly for *E. coli* and dissolved oxygen. Squalicum Creek was rated as "Threat" because of the chronic foam, yellow hue, and warm water temperature while Whatcom Creek was rated as "Watch" for some *E. coli* and water temperature exceedances.

Purpose

Stormwater is the single largest source of pollution to the Salish Sea and is one of the biggest threats to this ecosystem. It is also harmful to people, particularly the Coast Salish who consume large quantities of food from the Salish Sea. Monitoring large stormwater outfalls that dump into Bellingham Bay on a regular basis helps to pinpoint illicit discharges and other sources of pollution with the intent to find the source of pollution and fix it. The outfalls and creeks that are monitored drain the majority of the built out area of downtown Bellingham and includes residential housing, businesses, industry, and public parks and trails. The outfalls themselves drain a total of approximately 140,000 linear feet of pipe.

Stormwater permit holders such as the City of Bellingham (COB) and the Port of Bellingham have minimal monitoring requirements and are faced with staff and resource shortages and are unable to adequately monitor all of the outfalls in Bellingham. Local and state stormwater managers were consulted during the early stages of this project and have been kept informed throughout the project. This project will help inform stormwater managers about the quality of the stormwater entering the Bay and hopefully help focus efforts on problem spots.

Methods

The six outfalls and 2 creeks that were chosen for monitoring all dump into Bellingham Bay and drain significant portions of the built out areas of downtown Bellingham. See the end of Appendix 1 for a map of the outfall and stream sampling locations.

Outfall Names and Descriptions:

1. Broadway Street Outfall: This outfall drains much of Columbia Neighborhood - specifically the area bordered by Broadway St to the southeast, W Illinois St to the northwest, and Squalicum Creek to the northwest. It dumps into the I & J Waterway and is underwater during moderate to high tides.
2. C Street Outfall: This outfall drains much of the industrial area in the Central Waterfront property that is on either side of C St just southwest of Roeder Ave along with the Lettered St neighborhood that resides in the area that is southwest of Dupont St.
3. Cornwall Avenue Outfall: This outfall drains Cornwall Ave up to Laurel St.
4. Cedar Street Outfall: This outfall drains the hillside that originates up at Western Washington University.
5. Boulevard Outfall: This outfall drains the hillside that is directly above and north of Boulevard Park.
6. Bennett Street Outfall: This outfall drains the hillside that is directly above and south of Boulevard Park.

Creek Names and Descriptions:

1. Squalicum Creek: Squalicum lake is the headwaters to this urban creek and is located near the intersection of SR 542 and the Y road. It flows through agricultural land, residential, commercial, and industrial areas and towards the outlet is bordered by Squalicum Way which is a popular truck route, therefore, has considerable stormwater input. Much of the creek's watershed is developed and impervious and its water levels rise and fall dramatically following rain events, furthermore, it suffers from low flow events during the summer because it does not have snow melt to feed it.
2. Whatcom Creek: Lake Whatcom is the headwaters to this creek and the flow is dam controlled. The creek flows through public parks, industrial areas, along with residential and commercial areas and also has considerable stormwater input.

For a more detailed look at where stormwater flows in Bellingham visit the CIty of Bellingham's website (www.cob.org) and go to "Maps" and then "CityIQ". Open CityIQ and click on "I want to…" and select "change visible map layers". In the layers, select "Utilities

Information” then click on “Storm Utilities”. Remove any unnecessary layers to simplify the map.

The water quality standards that are used for the two creeks in this study are taken from Water Quality Standards for Surface Waters of the State of Washington and the standards for the stormwater outfalls are taken from the Illicit Connection and Illicit Discharge Field Screening and Source Tracing Guidance Manual (link to references are below).

Sampling

Pilot testing began in December 2020 and monthly monitoring of all sites began in Feb 2021. Samples were collected by car and by kayak or canoe during times when the tides were at or lower than + 2.0. Several of the outfalls are under water during higher tides. Testing done during the winter months (November, December, and January) were conducted during the evening with headlamps as that was the only time that the tide was low enough to monitor. See Appendix 1: Project Procedure Sheet and Appendix 2: Data Sheet for a detailed explanation of what data was collected, how it was collected, and which water quality standards are used here.

When exceedances are found, reports are sent to the Washington State Department of Ecology (Ecology’s Emergency Response Tracking System) and/or the COB Stormwater Hotline. This helps hold both regulators and polluters accountable.

Results

All of the data is located and displayed within the Water Reporter Map (link). Below is an overview of the results with a corresponding rating for each monitoring site. Sites were assigned 1 of 3 ratings: Threat, Watch, or Good, respectively.

- Threat (red): This signifies that the site has severe exceedances for any given parameter that occur regularly (not just once or twice).
- Watch (yellow): This signifies that the site has some exceedances for any given parameter but they are either very infrequent or unable to link to a pollution source.
- Good (green): This signifies that the site rarely has an exceedance for any given parameter and when it does occur it is not egregious.

Note:

The dissolved oxygen probe was not working for 2 sampling events: April and May, 2021 Water temperature was not considered when calculating ratings for outfalls because the researchers felt that ambient temperature was not well defined or measured. None of the temperature data collected suggest that there was abnormal water temperature associated with an illicit discharge. Water temperature was considered for creeks because there are specific water temperature criteria to support aquatic life, most notably salmon (see Appendix 2).

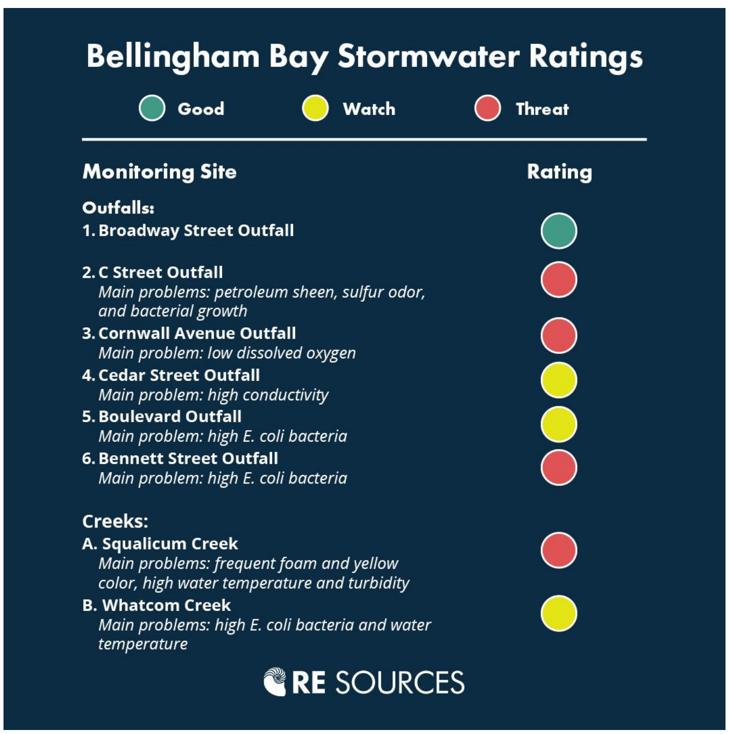
***Outfalls*:**

1. Broadway Street Outfall: 5 exceedances were noted including: 1 *E. coli* count of 600 cfu (300 cfu is the standard), 2 times the water had a yellow hue, and twice the outfall had a sulfur odor.
   Rating: Good
2. C Street Outfall: 27 exceedances were noted including: 4 dissolved oxygen, 2 conductivity, 2 *E. coli* (one of which was over 6 times the limit), 7 visual (sheen and white microbial mat), 6 odor (sulfur), 6 color (yellow and white hues). Beginning in July 2021, a white microbial mat was observed growing on the rocky substrate directly below the outfall and on the eel grass. As of March 2022, the mat is still present and at times makes the water milky white, extending from inside the outfall and many yards downstream from the mouth of the outfall. It has been identified as a bacterial mat but the species is not yet known. Researchers suspect that the bacteria is feeding on sewage.
   Rating: Threat
3. Cornwall Avenue Outfall: 9 exceedances were noted: 7 dissolved oxygen, 1 *E. coli*, and 1 color (yellow hue). Dissolved oxygen is chronically low at this outfall and failed more than 60% of the time.
   Rating: Threat
4. Cedar Street Outfall: 11 exceedances were noted: 2 *E. coli*, 8 conductivity, and 1 odor (sulfur). Conductivity is chronically high at this site but conductivity can be influenced by both natural and anthropogenic factors. Naturally occurring minerals in the soil, for example, can cause high readings.
   Rating: Watch
5. Boulevard Outfall: 5 exceedances were noted, all *E. coli*, one being over 6 times the limit.
   Rating: Watch
6. Bennett Street Outfall: 11 exceedances were noted: 10 *E. coli* and 1 color (yellow hue). *E. coli* is chronically high at this site and sometimes very high. One reading was 23 times the limit and other readings were 3-5 times the limit.

Rating: Threat

Creeks:

1. Squalicum Creek: 18 exceedances were noted: 1 dissolved oxygen, 2 water temperature, 2 turbidity, 1 *E. coli*, 6 visual (foam), and 6 color (yellow). This creek chronically has white foam floating in it. Foam can be naturally occurring but is often a sign of excess nutrients from fertilizers or manure in the water. The creek was often yellow in color as well. Having high temperatures and low dissolved oxygen make this stream inhospitable to salmon.
   Rating: Threat
2. Whatcom Creek: 7 exceedances were noted: 3 *E. coli* and 4 water temperature. The high water temperature makes this water inhospitable to salmon and is concerning. This creek has chronic bacterial problems and the City has developed a Total Maximum Daily Load (TMDL) plan to reduce the bacteria.
   Rating: Watch



Discussion

The preliminary results from this 1 year of sampling suggest that the water that flows into Bellingham Bay chronically exceeds water quality standards set by Washington State. *E. coli* bacteria was the most common water quality issue followed by (in order): color, conductivity, dissolved oxygen, odor, and visual.

Our reports to the Department of Ecology and the City of Bellingham have helped to eliminate some of the pollution encountered. A car leaking petroleum onto C St's outfall was removed, 2 RVs that were dumping sewage into the storm drains were removed, and the bacteria mat is currently being identified to species to help isolate the pollution it may be associated with.

The high bacteria counts found at Boulevard and Bennett still need to be addressed particularly because these areas are popular for recreation including swimming. Testing the marine waters in these areas for bacteria would help understand if the bacteria coming from the outfalls is making this water unsafe to swim in.

The high conductivity readings at the Cedar outfall are unknown as well. This drainage system travels under a Model Toxics Control Act (MTCA) Cleanup site called RG Haley where wood was treated with petroleum products. The Cornwall Landfill MTCA site sits next door. It is unknown whether either of these cleanup sites are contributing to these exceedances. Both of these sites are expected to be cleaned up within a few years and it will be interesting to see if the water quality changes after the cleanup work.

E. coli bacteria is likely coming from dogs and humans. There are an estimated 20,000 dogs in Bellingham and everyone that owns a pet needs to clean up after them. We recommend that the City install more dog waste stations and more trash cans especially in public areas near waterways. We also recommend the City install more port-o-potties and dumpsters for those experiencing homelessness. The Port of Bellingham has portable pump out stations for boats - perhaps this is a model that could be adopted to the streets for people living in RVs. Creating more affordable housing and providing services to those in need can also have positive benefits to our environment and should be included in these solution discussions.

Resources

1. WA Stormwater Center: https://www.wastormwatercenter.org/
2. Stormwater Action Monitoring (SAM) Program

3. Water Quality Standards for Surface Waters of the State of Washington: Freshwater Designate Uses and Criteria
4. IC-ID Field Screening and Source Tracking Manual
5. COB Surface and Stormwater and Comprehensive Plan 2020

Appendix 1

Bellingham Bay Monitoring Project Procedure Sheet

Before you head out

- ❏ Calibrate the YSI (takes about 30 min)
- ❏ Assemble Equipment (take Coliscan broth out of freezer night before if possible and label with location and date)

Map of Sites	Plastic gloves	Ammonia strips and vial
Data sheets	YSI (2 extra C batteries)	Sampling container for FC
Procedure sheet	2 Buckets (big enough to fit YSI)	Coliscan broth (9)
Plastic folder	Distilled water	Pipette
Pen/pencil	Phone/watch/camera	Pipette tips (9)
Sharpee	Turbidity tube	Cooler bag and ice
Hand sanitizer		

- ❏ Fill out top of Bellingham Bay Stormwater Monitoring Data Sheet
- ❏ Randomly choose a location to duplicate (number between 1 and 8)

Tide height at start: NOAA Tides and Currents for Bellingham Bay
Rainfall past 72 hrs (in): NOAA Weather Bellingham Airport (3-day history, past 72 hrs)

Methods for when in the Field

1. Flow: Note the flow of water coming out of the creek or pipe. Creek: Low, Moderate, High (put L, M, or H in data box). Pipe: None, Trickle, or Moderate (put N, T, or M in data box)

2. Color: Color is assessed qualitatively using visual observations of how severely a sample is discolored. Observations included brown, reddish brown, light green etc… Record on a 0-3 scale (none, slight, moderate, strong). Ex: Brown (3)

3. Odor: Odor observations are documented by describing the intensity or severity of odor based on a scale of 0 to 3 (none, faint, moderate, or strong). A faint odor is

barely noticeable, a moderate odor is easily detectable, and a strong odor can be detected from several feet away. Ex: rotten eggs (2)

4. Visual Indicators: Observe any sheen, floaters, foam etc… record on a 0-3 scale (none, few/slight, many/moderate, numerous/obvious), take a photo to document. Ex: sheen (1)

5. YSI multimeter:
    a. Water Temperature (T) °C
    b. Dissolved Oxygen (DO) mg/L
    c. Specific Conductivity (SPC) μS/cm
    d. Salinity (ppt)
    e. pH
    1. Be sure hands are clean or wear nitrile gloves to avoid sample contamination and protect yourself from potential contaminants.
    2. Rinse the plastic bucket 3 times with the outfall or creek water to be sampled and then collect a field sample. Avoid collecting sediment with the water sample.
    3. Rinse the probe with Distilled water
    4. Dip the probe in the water sample and stir gently for a few seconds. Allow up to 1 minute for the probe to adjust to the sample temperature and the readings to stabilize (when bars stop flashing). Note: parameters should be measured as soon as possible after the sample has been collected as conditions in the bucket will change quickly.
    5. Record the values shown on the meter on your field data sheet, notebook, or field laptop/tablet. Click enter to save data on the YSI under Bham SW.
    6. Dispose of sample back to source

6. Turbidity (cm): Turbidity Tube
    1. Place the turbidity tube on a level, stationary surface. It may be helpful to place a sheet of white paper or a white binder underneath the tube.
    2. Be sure hands are clean or wear nitrile gloves to avoid sample contamination and protect yourself from potential contaminants.
    3. Collect a field sample in a clean, sample bucket. Avoid collecting sediment with the water sample.

4. Pour the field sample into the turbidity tube until it reaches the top. If you can see the Secchi disk (black and white symbol) record 55+ cm. Slowly let the water out of the bottom until the Secchi disk marking at the bottom of the tube just becomes visible.
5. Read the gradation (marking) on the turbidity tube corresponding to the height of the sample in the tube.
6. Optional: Convert the height (in centimeters) to nephelometric turbidity units (NTU) using the following table (based on tube length of 60 centimeters). Alternatively, turbidity can be calculated using the following equation and the tube depth (in centimeters): Turbidity (NTU) = 2198.1 * (Tube Depth^(-1.2765)). Conversion Chart.
7. Dispose of sample back to source.

7. Ammonia (mg/L): Test Stips
    1. Be sure hands are clean or wear nitrile gloves to avoid sample contamination and protect yourself from potential contaminants.
    2. Rinse the sample vial 3 times with the outfall or creek water to be sampled and then collect a field sample. Avoid collecting sediment with the water sample.
    3. Remove one strip from the test strip container and replace the cap tightly.
    4. Dip the strip into your sample making sure both test pads are submerged in sample water. Move the strip back and forth for 30 seconds.
    5. Remove the strip and gently shake off any excess liquid.
    6. Wait 30 seconds for the color change to occur.
    7. Match the color(s) on the test pad(s) as closely as possible to the color scale on the test strip container.
    8. Record the value(s) on your field data sheet, notebook, or field laptop/tablet.
    9. Dispose of sample back to source.
    10. Store test strips at room temperature and avoid exposure to light when not in use. Replace test strips after 3 to 5 years.

8. *E. coli* bacteria (#cfu/100 ml): Method: Coliscan© Easygel©
    1. Remove the frozen Easygel© nutrient bottles from the storage freezer the night before the sampling day and thaw them at room temperature overnight. (Note: If this step is forgotten, the bottles may be thawed by placing them in a pocket or on a warm vehicle dashboard).

2. Be sure hands are clean and wear nitrile gloves in the field to avoid sample contamination and protect yourself from potential contaminants. Do not touch the inside of the Easygel© nutrient bottle or cap.
3. Put on a clean pipette tip, flush it 3 times with sample water (discarding waste water downstream).
4. Pipette the sample (5 mL) directly from the flowing water or from a sampling container, such as a sample bottle (that has been rinsed 3 times with the outfall or creek water to be sampled). Make sure to empty the rinse water either downstream or away from your sampling location, to not disturb streambed or other bottom sediments.
5. Pipette the aliquot of sample directly into the Easygel© nutrient bottle.
6. Tightly screw the lid back on the Easygel© nutrient bottle. Label the container with the date and location of the sampling spot if you haven't already.
7. Keep the samples (now in the Easygel© nutrient bottles) at 4°C (40°F) by placing them in an ice-filled cooler; return them to the office within 6 hours of sampling.
8. Clean pipette tips in a bleach solution and dry thoroughly to be used again.

After sampling

- ❏ Look for exceedances and circle on data sheet contact COB/ECY if significant exceedances.
- ❏ Rinse, dry equipment
- ❏ Culture bacteria
    1. Label the tops of the Easygel© Petri dishes with unique ID, location, and date with a permanent marker.
    2. Transfer the samples (contained in the Easygel© nutrient bottles) carefully to the bottom plates of the Petri dishes.
    3. Ensure that the nutrient/sample mix is distributed evenly on the Petri dish bottom; typically just by pouring carefully.

4. Place the labeled Petri dish tops onto the dishes, and place them into an incubator, being careful not to slosh or disrupt them. (You can also pour the gels while they are sitting in the incubator). The gel in the bottom of the dishes will solidify in about an hour.
5. If an incubator is available, incubate at 95°F (35°C) for 24 hours. If an incubator is not available, incubate at room temperature for 48 hours. Note: An incubator is recommended for improved control, temperature consistency, and faster incubation.
6. Remove Petri dishes from the incubator (if applicable).
7. Inspect the Petri dish.
    a. Fill out the top parts of Coliscan Count Template for 9 sampling sites. The locator is the name of the sampling site and unique ID# (BBSW_1, BBSW_2)
    b. Count all the easily-seen dark blue or dark purple-blue colonies on Petri dishes to quantify E. coli bacteria present.
    c. Disregard light blue-green, red or pink colonies or irregularly shaped, light-colored growths. Disregard any "pinprick" size colonies. However, if in serious doubt as to whether a colony color is "blue," "purple-blue," or "blue-green," it is acceptable to err on the side of caution and count "ambiguous" colonies as E. coli bacteria.
    d. Report the results in terms of colony forming units (CFU) per 100 mL of water. To do this, multiply the plate count by the appropriate multiplier to obtain *E. coli* CFU/100 mL. For example, for 5 mL sample aliquots, the multiplier is 20.
    e. Photograph the plates, typically with a completed plate count template, for documentation and for future reference if needed. Name the photo file with the unique ID.
    f. Dispose Easygel© bottles by throwing them directly into the trash.
    g. Disinfect the bottom plates of the Petri dishes by placing them into a sink, pouring straight bleach or a 50/50 bleach/water mix into them, letting them sit for 5 minutes, carefully draining them, bagging them into a plastic bag, and placing the bag in the trash.

❏ Enter all data as written on the data sheet with these exceptions:
1. Water Temp (2 places to record)
    a. Actual: Record what is on the data sheet.
    b. Categorical: If the water temperature is less or equal to the highest air temperature during sampling time then enter 0, if the water

temperature is above the highest air temperature then enter 1. The 1 will indicate that this is an exceedance.

2. Specific Conductivity (2 places to record)
    a. Actual: Record what is on the data sheet.
    b. Fresh Water: Record ONLY if the salinity is less or equal to 0.5 ppt. Marine water intrusion will cause very high SPC values which don't need to be recorded as exceedances.

Descriptions of Parameters - What they indicate

1. Outflow: Flow in an outfall during dry weather is an indicator that a water source other than stormwater is flowing through the storm drainage system. It could be natural, groundwater flow but could also be sanitary sewer cross-connection, potable water (swimming pool, hydrant flushing), or illegal dumping.

2. Color: The color of water is influenced by the presence or absence of substances such as metallic salts, organic matter, dissolved or suspended materials. Color can indicate when stormwater has been contaminated by an illicit discharge or illicit connection, but not all illicit discharges will have a color.

3. Odor: Odor should be assessed qualitatively in the field using your nose to determine if a water sample has a distinct smell. Odor observations are subjective and may include descriptions such as a petroleum, sewage, or chemical odor.

4. Visual Indicators: Visual indicators other than color, odor, and flow can often indicate when stormwater has been contaminated by an illicit discharge or illicit connection; however, not all illicit discharges will have visual indicators. Visual indicators are assessed qualitatively by field staff using simple visual observations. Ex: abnormal vegetation, algae/bacteria/fungus, deposits/staining, fish kills, floatable, surface film/sum/sheen, or trash/debris.

5. YSI multimeter
    a. *Water Temperature* (*T*) °C: Temperature extremes can threaten the health and survival of fish and other aquatic species in many life stages including embryonic development, juvenile growth, and adult migration. Water temperature can be useful in identifying contamination by sanitary

wastewater or industrial cooling water. Household and commercial sewage produces heat due to microbial activity during anaerobic decomposition, while industrial cooling water is heated as it is circulated through heat exchangers. Water temperature measurements are typically the most useful for IDDE when indicator sampling is being conducted during cold weather and temperature differences can be significant.

b. *Dissolved Oxygen (DO) mg/L*: DO is an important parameter for salmonids and other aquatic organisms. Low dissolved oxygen levels can be harmful to larval life stages and respiration of juveniles and adults. DO depends on local hydraulic conditions affecting the oxygenation of the discharge. For this reason, DO is not a widely useful indicator for illicit discharges.

c. *Specific Conductivity (SPC) µS/cm*: Specific conductivity, also referred to as specific conductance, is a measure of how well water can conduct an electrical current based on ionic activity and content. Specific conductivity is an indicator of dissolved solids from potential pollutant sources such as sewage and washwater, and can help distinguish groundwater from illicit discharges and identify commercial/ industrial liquid waste if used in combination with another parameter such as Hardness, Turbidity, or Detergents/Surfactants. Specific conductivity can also be used in combination with caffeine or pharmaceuticals (see Other Indicators) to indicate sanitary wastewater.

d. *Salinity (ppt)*: This is the saltiness or dissolved inorganic salt content of water. The Pacific Ocean has an average salinity of 34 parts per thousand (ppt) compared to 29 ppt in Puget Sound. Measuring salinity will indicate if there is saltwater intrusion in the outfall or creek.

e. *pH*: pH measures the hydrogen ion activity on a scale from 1 to 14. Water with a pH below 7.0 is acidic and water with a pH above 7.0 is alkaline or basic. pH values that are lower than 6.5 or higher than 8.5 may be harmful to fish and other aquatic organisms. A low pH can cause heavy metals to leach out of stream sediments, resulting in an increase in dissolved metals concentrations. A high pH can produce a toxic environment, in which ammonia becomes more poisonous to aquatic organisms.

6. Turbidity (cm): Turbidity is a measure of how transparent or clear water is based on the amount of sediment or suspended particulates. Large amounts of suspended material can affect fish growth and survival by impairing their vision, gill function, and affecting egg and larval development. Higher turbidity can also increase temperature and thereby decrease dissolved oxygen concentrations in water bodies,

affecting the growth of both aquatic animals and plants. High turbidity in water can be contributed to many different sources including soil erosion, construction activities, sanitary wastewater, excessive algal growth, or industrial processes.

7. Ammonia (mg/L): Ammonia is produced by the decomposition of plant and animal proteins and is also a main ingredient in fertilizers. The presence of ammonia in surface water usually indicates contamination from fertilizers (including manure), pesticides, sanitary wastewater (including human waste, wash water, and septic system), or a commercial/industrial source. Trace amounts over time can be toxic to fish and higher concentrations can result in low DO.

8. *E. coli* bacteria (#/100 ml): have been typically-used as indicators of fecal contamination of stormwater and natural waters, as they are present in the fecal waste of warmblooded animals, including humans. A relatively elevated test result for fecal coliform bacteria or E. coli bacteria may indicate an illicit discharge or illicit connection associated with sewage or a failing septic system. However, it may indicate waste related to large domestic animals (such as cows, llamas, etc.), pets, or wild animals.

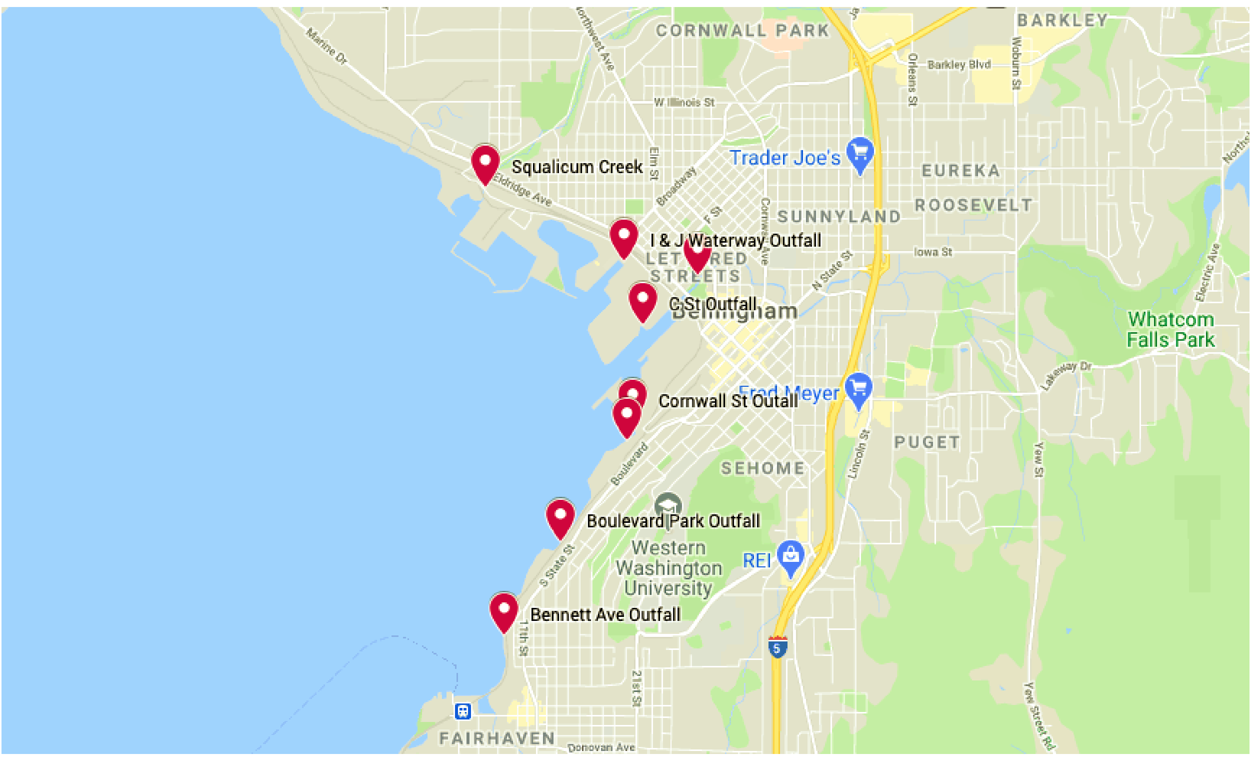
Sampling Locations

Name	**Latitude, Longitude**
Squalicum Creek	48.761139, -122.508478
Whatcom Creek	48.754550, -122.483300
Broadway St OF	48.755745, -122.492252
C St OF	48.750420, -122.489911
Cornwall St OF	48.743003, -122.490756
Cedar St OF	48.741621, -122.491588

Boulevard Park OF	48.733642, -122.499516
Bennett St OF	48.726423, -122.506205

Resources and Equipment

WA Stormwater Center: https://www.wastormwatercenter.org/
Stormwater Action Monitoring (SAM) Program
IC-ID Field Screening and Source Tracing Manual
COB Surface and Stormwater and Comprehensive Plan 2020
www.hach.com - ammonia test strips
Forestry suppliers - 60 cm turbidity tube
Waterproof map cover -
Eight Sampling Locations:



Appendix 2

Bellingham Bay Stormwater Monitoring Data Sheet   DATE: _________

Investigator(s):	
Tide Height:	Rainfall past 72 hr (in):
Observed Weather (circle): Sunny/Clear Partly Cloudy Overcast Light Rain Moderate Rain Heavy Rain Snow	
Air T (ºC) - Start: Finish:	Time - Start (24h): End (24h):

CREEK SAMPLING:

Sampling Site:	**Squalicum Creek**	**Whatcom Creek**	**Duplicate**	**WA State Freshwater Standards***
Arrival Time				--------------------------------------
Flow (**L**ow, **M**oderate, **H**igh)				--------------------------------------
Color (0-3)				Any non natural source (≥ 1)
Odor (0-3)				Any non natural source (≥ 1)
Visual (0-3)				Any non natural source (≥ 1)
Water T (ºC)				> 16ºC (1≤ 16; 2 > 16)
DO (mg/L)				< 8.0 mg/l
SPC (>1 mg/L)				None but note if > 500 µS/cm
Salinity (ppt)				n/a
pH				< 6.5 or > 8.5
Turbidity (cm)				Squalicum: < 46 cm** Whatcom: < 60 cm

Ammonia (mg/L)				> 1 mg/L
E. coli (cfu/100 ml)				> 320 cfu/100 ml (100 geomean)
Notes				

*Salmonid Core Summer Habitat and Primary Contact **5 NTU above calculated background data from COB 2011-2020 monthly sampling

OUTFALL SAMPLING:

Sampling Site:	Broadway St OF	C St OF	Cedar St OF	Cornwall St OF	BLVD Park OF	Bennett Ave OF	Duplicate_____	**Ecology Standards**
Arrival Time								-------------------------
Outflow (**N**one, **T**rickle, **M**oderate)								1 = normal; 2 = M+ during dry weather
Color (0-3)								Any non natural phenom (≥ 1)
Odor (0-3)								Any non natural phenom (≥ 1)
Visual (0-3)								Any non natural phenom (≥ 1)
Water T (°C)								1 < ambient air T; 2 > ambient air T
DO (mg/L)								< 6 mg/L
SPC (µS/cm)								> 500 µS/cm
Salinity (ppt)								---------------------------

pH								< 5 or > 9
Turbidity (cm)								< 19 cm
Ammonia (mg/L)								> 1.0 mg/L
E.coli (#/100 ml)								> 300 cfu/100 mL
Other								

Data Entered by: __________________________ date: _____________
Data Verified by: __________________________ date: _____________